

REVISION OF THE GENUS *CINNA* (POACEAE)

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ABSTRACT

Variational patterns and discontinuities were studied in *Cinna* (Poaceae). Nearly 4000 herbarium specimens of the genus were examined; four species were recognized on the basis of features of the spikelets. *Cinna arundinacea* inhabits moist forests in eastern North America; *C. latifolia* occupies similar sites in circumboreal regions; *C. poaeformis* occurs in mountainous areas from Mexico to Venezuela and Bolivia; and *C. bolanderi* is a central montane Californian endemic previously considered conspecific with *C. latifolia*. Keys, descriptions, illustrations, and distribution maps are provided for all species.

Cinna L. is a small but widely distributed genus of perennial grasses. It was originally described by Linnaeus (1753), who recognized *C. arundinacea* L., mostly a woodland species of eastern North America. Subsequent authors referred this species to *Agrostis* and *Muhlenbergia*, both of which differ from *Cinna* by several characters. Fernald and Griscom (1935) described *C. arundinacea* var. *inexpansa* Fern. & Griseb. as a southern Coastal Plain native supposedly differing from typical *C. arundinacea* by its more ascending panicle branches and its smaller spikelets.

A second species, the circumboreal *C. latifolia* (Trevir. ex Göpp.) Griseb. in Ledeb., was first described in 1830 as a species of *Agrostis*, *A. latifolia* Trevir. ex Göpp., by Treviranus (Göppert 1830). Trinius (Bongard 1833), however, considered the taxon to be a species of *Muhlenbergia*, *M. pendula* Trin. in Bong.; later he (Trinius 1841) transferred it to *Cinna* as *C. pendula* (Trin. in Bong.) Trin. The combination *Cinna latifolia* was made by Grisebach (Ledebour 1853). For several decades the epithet *pendula* — not *latifolia* — was misapplied to the species. Gray (1856) treated the taxon as *C. arundinacea* var. *pendula* A. Gray. Other authors named several varieties

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of *C. pendula*, and it was not until the late 19th century that the earlier specific epithet, *latifolia*, came into widespread use.

A third member of the genus, *C. poaeformis* (H.B.K.) Scribn. & Merr., is a montane species ranging from Mexico south to Venezuela and Bolivia. Originally described by Humboldt, Bonpland, and Kunth (1815) as *Deyouzia poaeformis* H.B.K., it has also been treated as belonging to *Calamagrostis* or *Poa*. The combination *Cinna poaeformis* was eventually made by Scribner and Merrill (1901). *Cinnastrum* of Fournier (1886), based on *Deyouzia poaeformis*, was established apparently because of Linnaeus' failure, in the original description of *Cinna*, to note the prolonged rachilla. Fournier characterized *Cinnastrum* by "*spiculus bifloris, flore superiore ad pedicellum sterile redacto.*"

A collection of *Cinna* from central California was recognized by Scribner (1884) as distinct from *C. latifolia*; he named it *C. bolanderi* Scribn. in honor of H.N. Bolander, who collected it in 1866. The species was later reduced to the synonymy of *C. latifolia* by Hitchcock (1935). We are reinstating it to specific rank; it is quite distinct from *C. latifolia* (see discussion under *C. bolanderi*).

Behrens (1877) gave a brief account of nervature of the palea of *C. arundinacea* and *C. latifolia*; Brandenburg et al. (n.d.) more fully described that of *C. arundinacea*. Chase (1911a) published a short paper on subterranean organs of "*Cinna arundinacea*"; she later discovered that the specimens she studied were *Arrhenatherum elatius* (L.) Presl (Chase 1911b). Störmer (1949) observed that just below the glumes of *Cinna* is a slight collar that, upon disarticulation of the spikelets from the plant, persists as a small cupule at the apex of the pedicel; he regarded this cupule to be of diagnostic value in differentiating from *Cinna* those Norwegian grasses likely to be confused with it. Several writers have noted that grains of *Cinna* contain semi-liquid endosperm (Dore 1956; Martin 1946; Terrell 1971).

Cinna clearly belongs to the subfamily Pooideae on the basis of spikelet morphology, in conjunction with evidence obtained from root-hair development (Row and Reeder 1957), features of the embryo (Reeder 1957), leaf anatomy (Brown 1958), and chromosome number (Bowden 1960; Davidse and Pohl 1978). Hitchcock (1950) included *Cinna* as a member of the Agrostideae, a tribe not recognized by most later authors (e.g., Strebbsins and Crampton 1961), who assigned the genus to Aveneae. Recently, Macfarlane and Watson (1982) reexamined the relationship between these two tribes; in their final analysis *Cinna* is placed in a circumscribed Agrostideae. However, Clayton and Renvoize (1986) classified *Cinna* in tribe Aveneae, subtribe Alopecurinae, the latter consisting of grasses with "spikelets 1-flowered; glumes commonly enclosing florets; palea not gaping."

TAXONOMY

We define *Cinna* as having the following generic characters: (1) spikelets 1-flowered, (2) disarticulation below the glumes, (3) awn (when present) subterminal, (4) rachilla typically prolonged behind the palea as a small glabrous or scaberulous stub or bristle, and (5) palea 1-nerved, or 2-nerved and the nerves very close together.

Two characters traditionally employed to define the genus should be mentioned. The first of these, the prolonged rachilla, varies from a minute stub in *C. arundinacea* to a slender bristle half the length of the lemma in *C. poaeformis*. However, this prolongation is often difficult to detect (especially in *C. arundinacea*), occasionally absent, and is therefore a poor character to use as the principal basis for identifying *Cinna* in a generic key (cf. Hitchcock 1950). The second feature associated with the genus is the presence of monandrous flowers. Although this holds true for *C. arundinacea* and *C. latifolia*, *C. poaeformis* and *C. bolanderi* have diandrous flowers. Because there is such a clear-cut distinction among the species of *Cinna* on this basis, there is a temptation to recognize two sections within the genus (especially when one considers that *C. arundinacea* and *C. latifolia* also have stipitate florets and 3-nerved lemmas, while *C. poaeformis* and *C. bolanderi* have more or less sessile florets and normally 5-nerved lemmas). However, even though *C. bolanderi* agrees with *C. poaeformis* in these characters, on the basis of macromorphology it is markedly similar to the other two species rather than to *C. poaeformis*. Also, lemmas of both *C. arundinacea* and *C. latifolia* on rare occasion have five nerves. Hence we decided against subdivision.

This revision is based on the study of about 4000 sheets of *Cinna*. To save space, specimens are not cited; such citations are given in Brandenburg (1980).

CINNA L., Sp. Pl. 1:5. 1753; Gen. Pl. 1:6. 1754.

Abola Adans., Fam. Pl. 2:31, 511. 1763. Based on *Cinna* L. *Blyttia* Fries, Novit. Fl. Suec. Mant. Alt. 2:2. 1839 (fide Berg 1966).

Cinnastrum Fourn., Mex. Pl. 2:90. 1886. Based on *Deyenxia poaeformis* H.B.K.

Tall perennials with solitary or caespitose culms, sometimes tinged with purple. Nodes and internodes glabrous or rarely somewhat scaberulous. Blades flat, the margins scabrous; adaxial and abaxial surfaces scabrous or smooth. Ligules scarious. Sheaths open, glabrous. Panicle branches spreading or ascending, the axis and pedicels scabrous to smooth. Spikelets laterally compressed, 1-flowered or very rarely with a second rudimentary or fertile floret above the first. Disarticulation below the glumes. Rachilla prolonged behind the palea as a minute stub or slender bristle, this smooth or scaberulous at tip, occasionally absent. Glumes acute, 1- or 3-nerved,

sometimes minutely awn-tipped; keel upwardly scabrous, body smooth or occasionally scaberulous, margins hyaline; first glume somewhat shorter than or equalling the second. Floret sessile or stipitate. Lemma similar to glumes, 3- or 5-nerved (the nerves parallel and often faint or obscure), with a short, straight, upwardly scabrous awn just below the apex (mostly awnless in *C. poaeformis*, sometimes awnless in the other species). Palea hyaline, mostly smooth, 1-nerved, or 2-nerved and the nerves very close together, upwardly scaberulous along the keel(s). Grain yellowish-brown, often beaked by the persistent style. Stamens 1 or 2. $x = 7$.

TYPE SPECIES: *Cinna arundinacea* L.

KEY TO THE SPECIES OF *CINNA*

1. First glume 3-nerved; spikelets \pm obtuse *A. C. poaeformis*
1. First glume 1-nerved; spikelets acute.
 2. Stamens 2; lemma 5-nerved; floret \pm sessile 3. *C. bolanderi*
 2. Stamen 1; lemma mostly 3-nerved; floret raised on a 0.1–0.65 mm stipe.
 3. Second glume prominently 3-nerved; spikelets typically 4–6 mm in length 1. *C. arundinacea*
 3. Second glume 1-nerved (very rarely 3-nerved); spikelets typically 2.5–4 mm in length 2. *C. latifolia*

Spikelets of the four species of *Cinna* are shown in Fig. 1; diagnostic features of the species, in Table 1.

TABLE 1. Diagnostic features of the species of *Cinna*

	<i>C. arundinacea</i>	<i>C. latifolia</i>	<i>C. bolanderi</i>	<i>C. poaeformis</i>
Length of spikelets, mm*	(3.5)4–6(7.5)	(2)2.5–4(5)	(3.6)4–5.5(6.3)	1.9–3(3.5)
Number of nerves on glume 1	1	1	1	3
Number of nerves on glume 2*	3	1(3)	1 or 3	3
Floret stipitate or sessile	stipitate	stipitate	\pm sessile	\pm sessile
Number of nerves on lemma*	3(5)	3(5)	5	5
Number of stamens	1	1	2	2
Anther length, mm	0.8–1.9	0.4–1.1	1.2–2.6	0.5–1.2

*The word "usually" should be understood here.

1. *Cinna arundinacea* L., Sp. Pl. 1:5. 1753. — (PHOTOTYPE: Linnaean Herbarium, IDC No. S-3-8! We designate this specimen as the lectotype, as a second specimen of original material, IDC No.S-3-6!, also exists.) — TYPE LOCALITY: CANADA.

Agrostis cinna Lam., Tabl. Encycl. 1:162. 1791. Based on *Cinna arundinacea* L. *Agrostis cinna* Pursh, Fl. Amer. Sepr. 1:64. 1814. Based on *Cinna arundinacea* L. *Cinna agrostidea* Beauv. ex Steud., Nom. Bot. 1:20, 198. 1821. Based on *Agrostis cinna* Lam. (*C. "agrostoides"* according to Hitchcock). *Muhlenbergia cinna* Trin., Gram. Unifl. 191. 1824. Based on *Agrostis cinna* Lam.

Cinna arundinacea L. var. *inexpansa* Fern. & Griseb., Rhodora 37:135, pl. 334, fig. 1, 2. 1935.

Plants 2.8–18.3 dm tall, somewhat bulbous at base. Nodes 5–13. Blades to 34.5 cm long, 3–19 mm wide. Ligule 2–10 mm long. Panicle green, gray-green, or purplish, 6.5–55 cm long, 1–22 cm broad, loosely to densely flowered; branches ascending to spreading. Spikelets acute, (3.5)4–6(7.5) mm long. Floret raised on a 0.25–0.65 mm stipe. First glume somewhat shorter than lemma, 1-nerved, (2.7)3.5–5(6.1) mm long; second glume equal to or slightly longer than lemma, 3-nerved, (3.5)4–6(7.5) mm long. Lemma 3-nerved, occasionally with an additional nerve along one or both sides, (2.7)3.5–5(6.4) mm long; awn 0.2–1.5 mm long, rarely absent. Palea 1-nerved, 2.4–4.6 mm long. Grain 2.1–2.8 mm long. Prolonged rachilla 0.1–0.4 mm long, sometimes absent. Stamen 1, anther 0.8–1.9 mm long. $2n = 28$ (Bowden 1960), 40 (Avdulov 1928, *vide* Fedorov 1969). The report of $2n = 40$ is suspicious because all other available counts for *Cinna* are on a base number of $x = 7$. Fig. 1A.

General range: eastern North America (Fig. 2A).

Habitat: most commonly found in moist woodlands, in swamps, along streams, and in upland woods, less commonly in wet meadows, marshes, and waste ground and along roadsides; elevation ca. 0–850 m.

Flowering and fruiting time: late summer and fall.

Discussion: *Cinna arundinacea* may be distinguished from *C. latifolia* primarily by its strongly 3-nerved second glume and secondarily by its larger spikelets. Inflorescence characters commonly employed in floras — *C. arundinacea*: panicle dense, the branches ascending versus *C. latifolia*: panicle loose, the branches spreading — are not reliable, as it is not uncommon for *C. arundinacea* to have very open panicles and drooping branches.

Two collections seen of *C. arundinacea* have not been mapped. The first is an August 1890 collection by Sandberg (PENN 25045) labeled "Isanti Co., Idaho." There is no Isanti County in Idaho, a state west of the range of

the species (the specimen may have come from Minnesota, where there is an Isanti County). The second sheet (*Sheldon* 268, MU), labeled "*Deschampsia caespitosa*," is from Clear Creek Co., Colorado. As this state is also west of the range of *C. arundinacea*, it is probable that somehow a mix-up of label data occurred.

Cinna arundinacea was attributed to Montana and northern North Dakota by McGregor et al. (1977). The voucher specimen (*Stephens* 67806, KANU) for the Montana report is a species of *Calamagrostis*. We were unable to locate any voucher for the North Dakota report.

2. *Cinna latifolia* (Trevir. ex Göpp.) Griseb. in Ledeb., Fl. Ross. 4:435. 1853. — TYPE LOCALITY: EUROPE. *Agrostis latifolia* Trevir. ex Göpp., Besch. Bot. Gart. Breslau 82. 1830.

Muhlenbergia pendula Trin. in Bong., Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Math. 2:172. 1833.

Cinna expansa Link, Hort. Berol. 2:236. 1833.

Agrostis suaveolens Blytt ex Sommerf., Kongl. Vetensk. Acad. Handl. 1837:256. 1838.

Blyttia suaveolens Fries, Novit. Fl. Succ. Mant. Alt. 2:2. 1839. Based on *Agrostis suaveolens* Blytt ex Sommerf. *Cinna suaveolens* Rupr. ex Ledeb., Fl. Ross. 4:435. 1853. Based on *Agrostis suaveolens* Blytt ex Sommerf.

Cinna pendula (Trin. in Bong.) Trin., Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Nat. 4:280. 1841. The earlier *Muhlenbergia pendula* Trin. not mentioned. *Cinna arundinacea* L. var. *pendula* A. Gray, Man. ed. 2. 545. 1856. Based on *Cinna pendula* (Trin. in Bong.) Trin.

Cinna pendula (Trin. in Bong.) Trin. var. *glomerula* Scribn., Proc. Acad. Nat. Sci. Phila. 1884:290. 1884. (LECTOTYPE here designated: *Tweedy* 664, US!).

Cinna pendula (Trin. in Bong.) Trin. var. *glomerata* Macoun, Cat. Canad. Pl. 2(V):393. 1890. Epithet ascribed to "Scribn.," error for var. *glomerula* Scribn.

Cinna pendula (Trin. in Bong.) Trin. var. *acutiflora* Vasey ex Macoun, Cat. Canad. Pl. 2(IV):203. 1888, nom. nud.; then, in the same Macoun work (p. 393. 1890), *C. pendula* var. *acutiflora* was published as a synonym of *C. pendula* var. *glomerula* Scribn. ("*glomerata*"). (LECTOTYPE here designated: *Macoun* 30004, US!; ISOLECTOTYPE: F!)

Cinna pendula (Trin. in Bong.) Trin. var. *mutica* Vasey in Macoun, Cat. Canad. Pl. 2(IV):202, 1888, nom. nud.; name validly published in Contr. U.S. Natl. Herb. 3:57. 1892. (LECTOTYPE here designated: *Cusick* s.n., US!; isolectotype: NY!).

Cinna latifolia (Trevir. ex Göpp.) Griseb. in Ledeb. var. *glomerata* Beal, Grasses N. Amer. 2:319. 1896. Epithet ascribed to "Scribn.," error for var. *glomerula* Scribn.

Plants 2–19 dm tall. Nodes 4–9. Blades to 28 cm long, 1–20 mm wide. Ligule 2–8 mm long. Panicle green or purplish, 3–46 cm long, 0.5–20 cm broad, loosely to densely flowered; branches spreading or sometimes ascending. Spikelets acute, (2)2.5–4(5) mm long. Floret raised on 0.1–0.45 mm stipe. Glumes \pm equal, longer than to shorter than lemma, each 1-nerved (second glume very rarely 3-nerved); first glume (1.8)2.5–4(4.7) mm long; second glume (1.9)2.5–4(5) mm long. Lemma 3-nerved (rarely faintly 5-nerved), the lateral nerves often

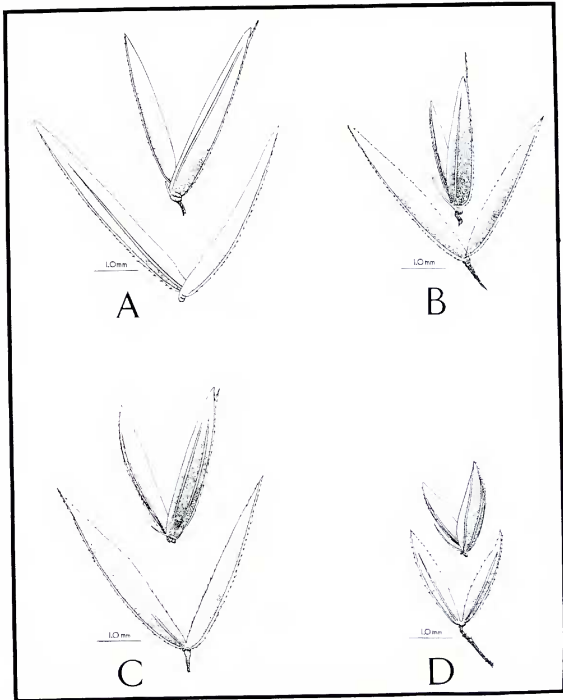


FIG. 1. Spikelets of *Cynna*. A. *C. arundinacea*. B. *C. latifolia*. C. *C. bolanderi*. D. *C. poaeformis*.

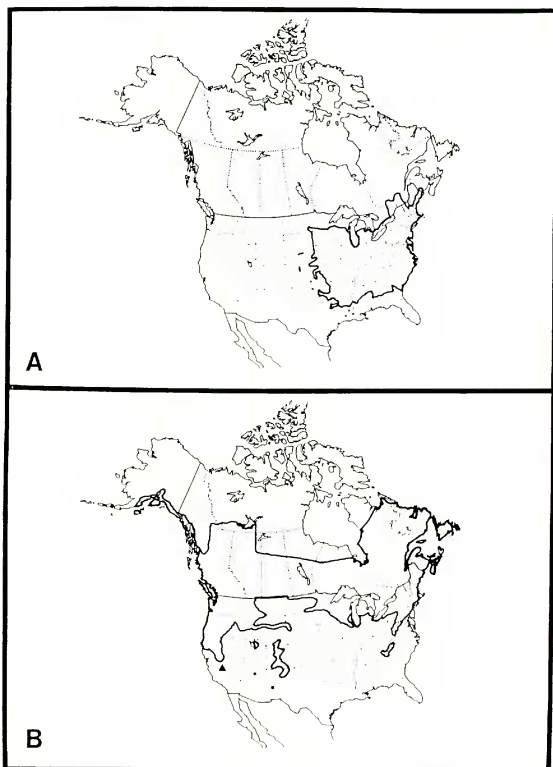


FIG. 2. Generalized range of *Cinna arundinacea*. *C. latifolia* (New World), solid line. *Cinna bolanderi*, California, triangle.

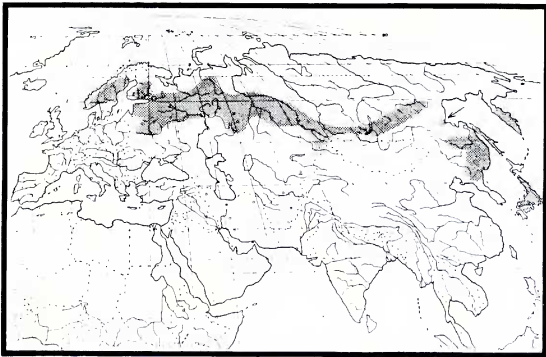


FIG. 3. Generalized range of *Cinna latifolia* (Old World). Adapted from Hultén and Fries 1986.

obscure, 1.8–3.8 mm long; awn 0.1–2.5 mm long or absent. Palea 2-nerved, the nerves very close together, or 1-nerved, 1.8–3.4 mm long. Grain 1.8–2.8 mm long. Prolonged rachilla slender, 0.1–1.3 mm long, sometimes absent. Stamen 1, anther 0.4–1.1 mm long. $2n = 28$ (Bowden 1960; Ehrenberg 1945). Fig. 1B.

General range: circumboreal (Fig. 2B, 3).

Habitat: moist to wet soil in woodlands, swamps, thickets, bogs, and streamsides; elevation ca. 0–2600 m.

Flowering and fruiting time: late summer and fall.

Discussion: Morphologically, this is the most variable of the species of *Cinna*, a fact doubtless accounting for the several varietal names proposed. There are no consistent differences between the Eurasian plants and those from the New World. A collection from the Aleutian Islands (Eyerdam 1791, UC, US) is peculiar with its abnormally large (to 5.5 mm) and often 2-flowered spikelets. These measurements are not included in the above description of *C. latifolia*.

Cinna latifolia was attributed to northeastern Montana and northwestern North Dakota by McGregor et al. (1977). We were unable to locate any vouchers to verify this report.

3. *Cinna bolanderi* Scribn., Proc. Acad. Nat. Sci. Philadelphia 1884:290. 1884. — (LECTOTYPE here designated: *Bolander* 6090, US(#323939)!; ISOLECTOTYPES: DS! GH! MO! NY! US!) — TYPE LOCALITY: central montane California. *Cinna pendula* var. *bolanderi* (Scribn.) Vasey, Contr. U.S. Natl. Herb. 3:57. 1892. Based on *Cinna bolanderi* Scribn.

Plants 8.5–20.3 dm tall. Nodes 4–8. Blades to 40 cm long, 2–19 mm wide. Ligule 3.5–7 mm long. Panicle green to golden green, 7.5–43 cm long, 3–18 cm broad, loosely to densely flowered; branches spreading to loosely ascending. Spikelets acute, (3.6)4–5.5(6.3) mm long. Floret ± sessile. First glume longer than to shorter than lemma, 1-nerved, (3.3)3.5–5.2(6) mm long; second glume longer than or equal to lemma, 1- or 3-nerved, (3.6)4–5.5(6.3) mm long. Lemma 5-nerved, the lateral nerves sometimes faint or obscure, (2.7)3.2–4.6 mm long; awn 0.2–1.5 mm long or absent. Palea 2-nerved (the nerves approximate), (2.7)3–3.5(3.8) mm long. Grain 2–2.9 mm long. Prolonged rachilla slender, 0.4–0.9 mm long, sometimes absent. Stamens 2, anthers 1.2–2.6 mm long (rarely underdeveloped and to 0.7 mm long). No chromosome number available. Fig. 1C.

General range: central montane California (Fig. 2C).

Habitat: meadows and streamsides; elevation ca. 1900–2400 m.

Flowering and fruiting time: late summer and fall.

Discussion: *Cinna bolanderi* is endemic to central montane California (Fresno, Mariposa, and Tulare counties); all collections we have seen are from Sequoia National Park, Kings Canyon National Park, and the southern tip of Yosemite National Park. *Cinna latifolia* is more northern in range in California, the southernmost record being from just north of Yosemite National Park. *Cinna bolanderi*, with its two stamens, is easily distinguished from the monandrous *C. latifolia*. Another noticeable difference is the length of the anthers, those of *C. bolanderi* being much the larger. Diagnostic characters for fruiting specimens of *C. bolanderi* are the larger spikelets, the sessile florets, and the 5-nerved lemmas (though the nerves are often faint).

4. *Cinna poaeformis* (H.B.K.) Scribn. & Merr., Bull. U.S.D.A., Div. Agrost. 24:21. 1901. — TYPE LOCALITY: MEXICO. *Deyeuxia poaeformis* H.B.K., Nov. Gen. Sp. 1:146. 1815. (TYPE: P!). *Poa subuniflora* Kunth, Révis. Gram. 115. 1829. Based on *Deyeuxia poaeformis* H.B.K. *Calamagrostis poaeoides* Trin. ex Steud., Nom. Bot. ed. 2. 251. 1840. Based on *Poa subuniflora* Kunth. *Cinnastrum poaeforme* (H.B.K.) Fourn., Mex. Pl. 2:91. 1886. Based on *Deyeuxia poaeformis* H.B.K. *Calamagrostis poaeformis* (Fourn.) Beal, Grasses N. Amer. 2:349. 1896. Based on *Cinnastrum poaeforme* Fourn.

Cinnastrum miliaceum Fourn., Mex. Pl. 2:91. 1886.

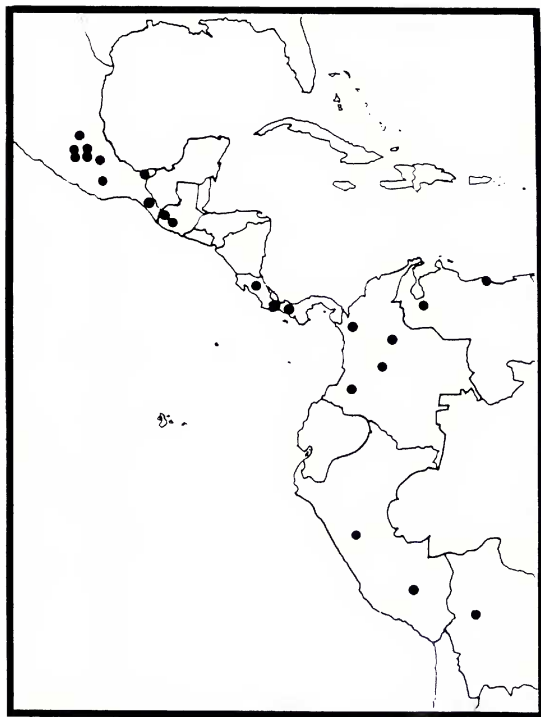


FIG. 4. Documented distribution of *Cinna poaeformis*.

Plants 2.8–22.2 dm tall. Nodes 4–9(11). Blades to 33 cm long, 1–18 mm wide. Ligule prominent, (1)5–12 mm long. Panicle green or purplish, 7–47 cm long, 1–18 cm broad, many-flowered; branches spreading. Spikelets \pm obtuse, 1.9–3(3.5) mm long. Floret \pm sessile. Glumes thick in texture, \pm equal, longer than to shorter than lemma,

each 3-nerved; first glume 1.8–3(3.4) mm long; second glume 1.9–3(3.5) mm long. Lemma thick in texture but tearing easily lengthwise, 5-nerved (one or both pairs of lateral nerves often obscure), (1.6)2–2.8(3.4) mm long; awn normally absent, to 0.4 mm long when present. Palea ± thick in texture, tearing easily lengthwise, 2-nerved (the nerves approximate), (1)1.7–2.4(2.9) mm long. Grain 1.3–1.8 mm long. Prolonged rachilla slender, 0.3–2 mm long, rarely absent. Stamens 2, anthers 0.5–1.2 mm long. $2n = 28$ (Davidse & Pohl 1978; Pohl & Davidse 1971). Fig. 1D.

General range: Mexico south to Venezuela and Bolivia (Fig. 4).

Habitat: mountains, in moist or dry soil of woods, meadows, and paramos; elevation ca. 2200–4000 m.

Flowering and fruiting time: late summer and late fall in Mexico; July through May farther south.

Discussion: *Cinna poaeformis* is the most dissimilar in outward appearance among the four species in the genus. Its spikelets are small, more or less obtuse, and normally awnless; they have a prominent prolonged rachilla. However, the species agrees wholly with the characters used to circumscribe the genus.

DOUBTFUL AND EXCLUDED SPECIES

Agrostis cinna Retz., *Observ. Bot.* 5:18. 1789. Originally as synonym of *Cinna arundinacea* L., but 2 years later Retzius (*Observ. Bot.* 6:22. 1791) concluded that his *A. cinna* was really a species of the genus now known as *Muhlenbergia*.

Calamovilfa poaeformis (Fourn.) M.E. Jones, *Contr. West. Bot.* 14:9. 1912. Based on *Cinnastrium poaeforme* Fourn. as to name but not as to description.

Cinna? alba Nees ex Steud., *Syn. Pl. Glum.* 182. 1855. (TYPE: *Gillies legit* Medoza. In US! is a sheet marked "Type" that has but one spikelet in a packet. The lemma has a long, curved awn and callus hairs, which does not agree with Nees' description, "*flosculi valvula inferiore mutica acuta.*")

Cinna arachnoidea Kunth, *Révis. Gramin.* 1:67. 1829 = *Muhlenbergia expansa* (DC.) Trin., *fide* Hitchcock, *Man. Grasses U.S.* 900. 1950. Based on *Agrostis arachnoidea* Poir.

Cinna arundinacea Hook., *Fl. Bor. Amer.* 2:238. 1840 (non L., 1753). Listed in *Index Kewensis*, but no such combination made by Hooker.

Cinna arundinacea Retz. ex Steud., *Nom. Bot. ed. 2.* 1:365. 1841 (non L., 1753) = *Muhlenbergia mexicana* (L.) Trin., *fide* Hitchcock, *Man. Grasses U.S.* 903. 1950. As synonym of *Cinna mexicana* Beauv.

Cinna brownii Rupr., *Beitr. Pflanzen Russ. Reich.* 2:66. 1845 = *Arctagrostis latifolia* (R. Br.) Griseb. in Ledeb., *fide* Nash, *N. Amer. Fl.* 17:498. 1937. Based on *Colpodium latifolium* R. Br.

Cinna crinita Trin., *Fund. Agrost.* 118. 1820 = *Dichelachne crinita* (L.) Hook. Based on *Anthoxanthum crinitum* L., which = *Dichelachne crinita*, *fide* Chase and Niles, *Index to Grass Species* 1:202. 1962.

Cinna decipiens Kunth, *Révis. Gramin.* 1:67. 1829. Based on *Agrostis decipiens* R. Br. (*Vilfa decipiens* Beauv.) = *Deyenxia decipiens* (R. Br.) Vickery, *Contr. New South Wales Natl. Herb.* 1:70. 1940.

- Cinna filiformis* (Willd.) Link, Enum. Pl. 1:70. 1821 = *Muhlenbergia mexicana* (L.) Trin., fide Hitchcock, Man. Grasses U.S. 903. 1950. Based on *Agrostis filiformis* Willd.
- Cinna filiformis* Llanos, Frag. Pl. Filip. 9. 1851 (non Link, 1821) = *Pogonatherum crinitum* (Thunb.) Kunth, fide Chase, J. Arnold Arbor. 31:131. 1950.
- Cinna glomerata* Walt., Fl. Carol. 59:1788 = *Andropogon glomeratus* (Walt.) B.S.P., fide Hitchcock, Man. Grasses U.S. 813. 1950.
- Cinna glomerata* (Link) Link, Hort. Berol. 2:237. 1833 (non Walt., 1788) = *Muhlenbergia glomerata* (Willd.) Trin., fide Hitchcock, Man. Grasses U.S. 902. 1950. Based on *Podosaeum glomeratum* Link.
- Cinna japonica* Nees ex Steud., Syn. Pl. Glumac. 182. 1854 = *Sporobolus elongatus* R. Br., fide Ohwi, Fl. Japan 176. 1965.
- Cinna karataviensis* N. Pavl., Vestn. Akad. Nauk Kazahsk. SSR 1:24. 1949 = *Agrostis gigantea* Roth ssp. *gigantea*, fide Tzvelev, Poaceae URSS:329. 1976. Earlier, *C. karataviensis* had been accepted as a species of *Cinna* in *Flora Kazakhstana* (Pavlov 1956). Two years later (Pavlov 1958), the taxon was referred to *Agrostis* (species not indicated). In 1968 (Kovalevskaya 1968) it was included in the synonymy of *Agrostis stolonifera* L., and, finally, in *Poaceae URSS* (Tzvelev 1976), as a synonym of *A. gigantea* Roth ssp. *gigantea*.
- Cinna? lanata* Kunth, Révis. Gramin. 1:67. 1829 = *Muhlenbergia pubescens* (H.B.K.) Hitchc., fide Soderstrom, Contr. U.S. Natl. Herb. 34:148. 1967. Based on *Agrostis lanata* H.B.K.
- Cinna lateralis* Walt., Fl. Carol. 59. 1788 = *Andropogon virginicus* L., fide Hitchcock, Man. Grasses U.S. 817. 1950.
- Cinna lateriflora* (Michx.) Kunth, Révis. Gramin. 1:67. 1829 = *Muhlenbergia frondosa* (Poir.) Fern., fide Hitchcock, Man. Grasses U.S. 901. 1950. Based on *Agrostis lateriflora* Michx.
- Cinna macroura* (H.B.K.) Kunth, Révis. Gramin. 1:67. 1829 = *Muhlenbergia macroura* (H.B.K.) Hitchcock, fide Nash, N. Amer. Fl. 17:468. 1935. Based on *Crypsis macroura* H.B.K. ("*C. macroura* Kunth" misapplied by Thurber in S. Wats., Bot. Calif. 2:276. 1880 to *Muhlenbergia rigens* (Benth.) Hitchcock).
- Cinna? mexicana* (L.) Beauv., Ess. Agrost. 32, 148, 158. 1812 = *Muhlenbergia mexicana* (L.) Trin., fide Hitchcock, Man. Grasses U.S. 903. 1950. Based on *Agrostis mexicana* L.
- Cinna mexicana* (L.) Link, Enum. Pl. 1:70. 1821 = *Muhlenbergia mexicana* (L.) Trin. Based on *Agrostis mexicana* L., which = *Muhlenbergia mexicana*, fide Hitchcock, Man. Grasses U.S. 903. 1950.
- Cinna ovata* Kunth, Révis. Gramin. 1:67. 1829 = *Echinopogon* sp. Kunth lists in synonymy *Agrostis ovatus* Forst., *Echinopogon ovatus* Beauv., and *Echinopogon asper* Trin.
- Cinna pbleoides* (H.B.K.) Kunth, Révis. Gramin. 1:67. 1829. Based on *Crypsis pbleoides* H.B.K. = *Muhlenbergia* aff. *nigra*, fide T.R. Soderstrom, pers. comm.
- Cinna? pubescens* (H.B.K.) Kunth, Révis. Gramin. 1:67. 1829. *Muhlenbergia pubescens* (H.B.K.) Hitchcock, fide Soderstrom, Contr. U.S. Natl. Herb. 34:148. 1967. Based on *Agrostis pubescens* H.B.K.
- Cinna? purshii* Kunth, Révis. Gramin. 1:67. 1829 = *Calamagrostis canadensis* (Michx.) Beauv., fide Hitchcock, Man. Grasses U.S. 839. 1950. Based on *Arundo agrostoides* Pursh.
- Cinna racemosa* (Michx.) Kunth, Révis. Gramin. 1:67. 1829 = *Muhlenbergia racemosa* (Michx.) B.S.P., fide Hitchcock, Man. Grasses U.S. 904. 1950. Based on *Agrostis racemosa* Michx.
- Cinna setifolia* (Presl) Kunth, Révis. Gramin. suppl. XVI. 1830 = *Muhlenbergia macroura*

- (H.B.K.) Hitchcock, *fade* Nash, N. Amer. Fl. 17:468. 1935. Based on *Crypsis setifolia* Presl.
- Cinna sobolifera* (Willd.) Link, Enum. Pl. 1:71. 1821 = *Muhlenbergia sobolifera* (Muhl.) Trin., *fade* Hitchcock, Man. Grasses U.S. 906. 1950. Based on *Agrostis sobolifera* Willd.
- Cinna? stricta* (Humb. & Kunth) Kunth, Révis. Gramin. 1:67. 1829 = *Muhlenbergia angustata* (Presl) Kunth, *fade* Chase and Niles, Index to Grass Species 1:507. 1962. Based on *Crypsis stricta* Humb. & Kunth.
- Cinna tenuiflora* (Willd.) Link, Enum. Pl. 1:70. 1821 = *Muhlenbergia tenuiflora* (Willd.) B.S.P., *fade* Hitchcock, Man. Grasses U.S. 906. 1950. Based on *Agrostis tenuiflora* Willd.
- Cinna valdiviana* Phil., Anal. Univ. Chile 1873:563. 1873. From description not a *Cinna*: "callo brevi pilosa"; "pedicellus pilosus rudimentum secundi floris sistens tertiam partem paleae inferioris aequat"; lower glume "univertia, vix dimidium paleam aequante."
- Cinnagrostis polygama* Griseb., Abh. Königl. Ges. Wiss. Göttingen 19:208–209, fig. 7. 1874. Incorrectly listed as synonymous with *Cinna* L. by Willis (1973). Grisebach's account of a grass with unisexual spikelets, hairs on the rachilla, and articulation above the glumes is descriptive of a genus other than *Cinna*.
- Muhlenbergia baicalensis* Trin. ex Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1):21. 1856. Published as synonym of *Cinna latifolia* (Trevir. ex Göpp.) Griseb. in Ledeb.

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GOODLAND, ROBERT. Ed. 1990. **Race to Save the Tropics: Ecology and Economics for a Sustainable Future.** Island Press, Box 7, Covelo, CA 95428. Price unknow. 219 pp.

This seminal book promotes the field of applied ecology as it relates to humid tropical ecosystems and their varied problems. Robert Goodland is to be commended for assembling the superior array of active tropical applied ecologists who authored the nine chapters of the book. Topics include agroecology and its role in the design of agricultural projects, applied agroforestry and natural forests management, agricultural pest management, dams and development in the humid tropics, the teaching of applied ecology to nationals in developing countries, and the integration of applied ecology into national conservation and development plans.

The growing awareness of the plight of global tropical rainforests indicates that the lessons of this book are certainly on target. An excellent resource text for the applied ecologists and a valuable information source for non-scientists. *Joe F. Kuban.*